



Showcasing Leaders in Water Innovation:
**Low Impact Development
Bus Tour**

September 24, 2013



a **Leader** for
CleanWater

Grey to Green

Transforming the way we think about rain

Urban landscapes have complex social, economic and environmental layers such as increasing population growth and density, fiscal constraints, aging infrastructure and unpredictable weather.

Municipalities both large and small must make decisions that consider these risks and uncertainties. They must maintain a level of service that meets federal and provincial policies and legislation. They must meet their own guiding documents and policies and, in some cases, those of an upper-tier region.

While solutions to stormwater management issues must be tailored to particular situations, low impact development (LID) practices have emerged as a **cost-effective measure** that can be incorporated into the existing urban form. LID helps improve water quality, reduce erosion and decrease runoff volume with minimal social disruption or loss of tax revenue. In new developments, LID has shown financial, social, aesthetic and environmental benefits for developers, homeowners and municipalities.

Through MOE's Showcasing Water Innovation grant, Mississauga, CVC and partners are being recognized both provincially and internationally as leaders in LID. Local manufacturers are gaining profile and helping build Ontario's local green economy while protecting our Great Lakes.

Today's tour is a unique chance to learn about cost and performance benefits of LID implementation. At our LID sites you will gain insight into infrastructure asset management tools to help you better mitigate risks under fiscal constraints. You will meet users and experts who have discovered tools and conquered challenges to optimize infrastructure and achieve maximum return on investment.

Thank you for joining today's tour. With the help of our partners, CVC is making an impact through LID tools, case studies, "how to" guides and monitoring results reporting that will give municipalities, agencies and professionals the information and guidance to make LID techniques mainstream.

Learn about the cost and performance benefits of low impact development (LID) implementation.

Gain insight into infrastructure asset management and mitigating risks under fiscal constraints and climate change pressures.

Discover opportunities and tools to optimize infrastructure and achieve maximum return on investment.

Streets, sidewalks and driveways contribute 65 to 75 per cent of pollutant loadings to waterways including total suspended solids, phosphorus, copper and zinc. **LID road retrofits have been found to save up to 25%** compared to traditional practices when land costs are considered. Targeting LID retrofits as part of road reconstruction projects makes sound economic and environmental sense.



Low Impact Development Sites:

Elm Drive: An innovative project combines permeable pavers and bioretention planters to transform a road right-of-way and an adult education centre at Elm Drive West, near Square One.

IMAX: A parking lot retrofit that improves water management using bioretention units, permeable pavers and an innovative Jellyfish® filter that pre-treats parking lot water runoff by removing large particles and oil/grease.

Lakeside Park: Several systems function to promote a healthy natural environment in the 25 acre Lakeside Park. These LID practices include a bioswale, green roof, and reused irrigation water from the park's splash pad.

Lakeview: Boulevard permeable pavers and bioretention units in the form of flower-filled gardens provide both beauty and storm water management on 1st and 3rd streets in the Lakeview community of Mississauga.

The July 8th Storm

A real-world test of LID infrastructure

On July 8, 2013 the GTA experienced a severe storm event. This event was responsible for flooding the Don Valley Parkway, stranding GO Transit trains, knocking out power, and flooding numerous basements particularly in the Cooksville neighbourhood of Mississauga. The estimated damage according to the Insurance Bureau of Canada is \$850 million and rising, making it the most expensive storm in Ontario's history.

The Elm Drive bioretention planters and permeable pavers were designed to infiltrate and clean stormwater for more frequently-occurring and severe storm events. Although not designed to control a storm of the intensity experienced on July 8th, the Elm Drive site provided a number of performance benefits:

- The bioretention cells delayed the peak discharge by 40 minutes compared to runoff that would have directly entered the storm sewer without the LID practices in place. This delay provides relief to receiving storm sewer infrastructure already burdened by high storm flows.
- The soil media rapidly filtered peak flows without surface ponding thereby treating and filtering all water from the site that will eventually flow to Cooksville Creek.
- There was no damage to the bioretention cells from the extreme event. The plants and soil media withstood the storm and no additional maintenance was required after the event.

What is a 100-year storm event?

A 100-year storm event drops rainfall totals that have a 1% probability of occurring at that location that year. The phrase is often misunderstood to be the total amount of rainfall seen at a location once in 100 years. In actuality, receiving rainfall totals of a 100-year storm event one day does not change the probability of receiving the same amount of rain the very next day. The science for classifying a 100-year storm is based on a statistical probability analysis based on normal rainfall amount for a specific location, which determines likelihood of intense storms or floods.

Overall on July 8th, Elm Drive LID practices provided stormwater infrastructure relief and resilience without requiring any additional maintenance. The LID practises at this site provide cost savings to municipalities both in short-term maintenance and long-term infrastructure replacement.



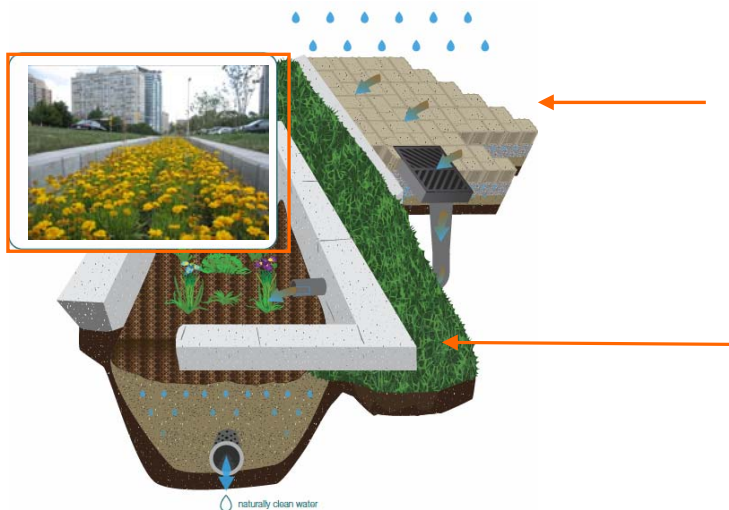
Elm Drive

Location: Mississauga
Constructed: May 2011



Project Overview

The Elm Drive low impact development (LID) road retrofit is located on Elm Drive West, just south of the Square One Shopping Centre in Mississauga, Ontario. The Elm Drive project incorporates both permeable paver lay-bys within the road right of way (on City of Mississauga property) and bioretention planters on the adjoining property owned by the Peel District School Board. Runoff flows from Elm Drive West onto the permeable paver lay-by and into to the bioretention planters.



Permeable Pavers

An alternative to traditional pavement, permeable pavers allow rainfall and road runoff to pass between joints in the pavers into an underground gravel storage layer. Stored water can infiltrate into the surrounding native soils.

Bioretention Planters

Runoff that is not infiltrated by the pavers is then transferred to bioretention planters, which provide additional infiltration and filter the runoff. The landscaped planters utilize specialized bioretention soil media to treat the stormwater before it is returned to Cooksville Creek.

Successes

The successes achieved with this project include:

Innovative project – The Elm Drive project is one of the first green street retrofits to take place in Ontario. The LID retrofit improves stormwater quality and reduces runoff at the site.

Joint partnership – A partnership was formed between three stakeholders: the City of Mississauga the Peel District School Board (PDSB) and Credit Valley Conservation (CVC). This partnership allowed the City to maintain the LID infrastructure, part of which is located on PDSB property. CVC provided design, construction assistance and is conducting performance monitoring and maintenance inspections.

Demonstration showcase – The LID features at Elm Drive have been showcased through numerous presentations, events and site tours. These efforts have helped educate numerous stakeholders on the benefits of LID.

Performance – Preliminary monitoring indicates that LID features are performing well, and that for the majority of rainfall events (up to 95% of all events) little to no stormwater runoff leaves the site.

Infrastructure Assessment

CVC is working with an expert advisory committee consisting municipalities, regional government, the MOE, consultants, universities and industry to assess the performance of the LID features at Elm Drive. Objectives include:

- To evaluate the performance of LID at controlling runoff volume, peak flows, quality, erosion and restoring the natural water balance.
- Determine whether the LID practices are working as designed and maintenance requirements for optimal LID performance
- Evaluate the degree to which LID reduces the impacts of extreme weather events due to climate change and builds resiliency in municipal infrastructure
- Meet the objectives of CVC's monitoring strategy report (available at www.bealeader.ca)

Performance Findings

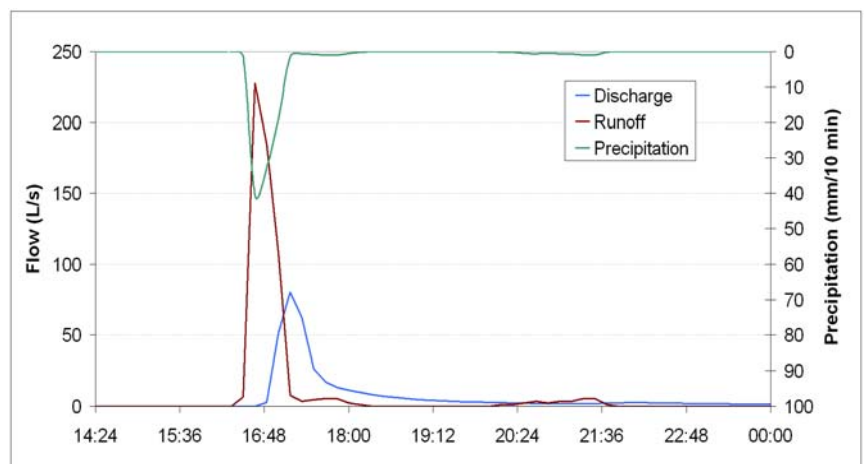
LID practices are exceeding all design expectations, providing significant benefits:

- **Rainfall events up to 25mm (95% of all events in a typical year) have no stormwater runoff**
- **99% total suspended solids removal**
- **Reducing peak flows up to a 2-year event**

100 Year Event - July 8, 2013

On July 8, 2013 an extreme event occurred over Elm Drive - 104 mm over 5 hours, peak intensity of 240 mm/hr for a duration of 10 minutes. Preliminary analysis indicates that this storm event exceeded the 100-year design storm.

As the figure shows, even for this extreme event, the LIDs at Elm Drive helped to provide peak and volume reductions and provide a 40-min lag time of discharge from site.



Proud Partners





IMAX Corporation

Location: Mississauga
 Constructed: Fall 2012

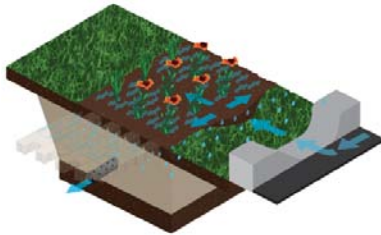


Project Overview

Credit Valley Conservation partnered with the IMAX Corporation to retrofit their parking lot with a variety of innovative stormwater management features including permeable pavers, three bioretention units and specialized stormwater treatment systems. The parking lot runoff is collected, absorbed and filtered by these low impact development (LID) practices before entering Sheridan Creek (which ultimately drains into Lake Ontario, the drinking water source for much of Ontario). The permeable pavers and other LID features have twice the lifespan of conventional asphalt, will help to reduce IMAX’s winter maintenance costs, provide green amenities for staff, and improve drainage. The use of these innovative features is helping create local green jobs and build market capacity for these made-in-Ontario technologies. Construction was completed in December 2012 with monitoring commencing in early April, 2013.

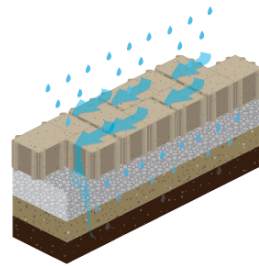
Bioretention units

Bioretention units infiltrate and filter parking lot runoff by utilizing specialized bioretention soil media and vegetation.



Permeable Pavers

An alternative to traditional pavement, permeable pavers allow rainfall and road runoff to pass between joints in the pavers into an underground gravel storage layer.



Jellyfish® Filter

This unit “pre-treats” the parking lot runoff by removing large particles and oil/grease. The treated runoff then flows into one of the bioretention units.

SorptiveMEDIA

This unit receives runoff from one of the bioretention units and provides polishing to remove phosphorus.



Successes

The successes achieved with this project include:

Innovative project – the parking lot retrofit is one of the first commercial parking lot retrofits in Ontario incorporating a variety of LID technologies. A LID “treatment train” has been implemented with the Jellyfish Filter and SorptiveMEDIA systems to go above and beyond the level of stormwater treatment typically provided in commercial parking lots.

Extended Infrastructure Lifespan – the parking lot retrofit with LID not only provides IMAX with a proper functioning parking lot but also doubles the lifespan of the lot, as permeable pavers have double the useful lifespan of asphalt.

Operation & Maintenance Savings - the permeable pavers will help to reduce O&M costs due to reduced de-icing salt application needed for permeable pavement versus asphalt.

Better Functioning Parking Lot – the greatest success of the project was providing IMAX with a better functioning parking lot with improved drainage, less maintenance and improved aesthetics. The old parking lot posed a number of issues, including crumbling asphalt and year-round nuisance ponding in the parking lot which would flood the outdoor electrical cabinets causing power outages in the building. With the new design, these new technologies will improve drainage and filter runoff before it enters Sheridan Creek and Lake Ontario.

Creating Green Jobs & Building Market Capacity for Innovative Technologies - the project is also spurring the growth of Ontario green jobs through the use and promotion of the specialized stormwater management systems – the Jellyfish® Filter, and SorptiveMEDIA. Testing of these new products will expand the go-to market specifically for designers, contractors, suppliers and manufacturers creating more local green jobs.

Demonstration showcase – LID features at IMAX Corporation have been showcased through numerous presentations, events, media and site tours.



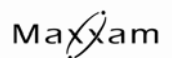
Aerial photograph of the site, showing the extent of the expanded parking lot.

Infrastructure Assessment

CVC is working with an expert advisory committee consisting municipalities, regional government, the MOE, consultants, universities and industry to assess the performance of the LID features at IMAX. Objectives include:

- To evaluate the performance of LID at controlling and reducing runoff volume, peak flows, quality, erosion and restoring the natural water balance.
- Determine whether the LID practices are working as designed and maintenance requirements for optimal LID performance
- Evaluate the degree to which LID reduces the impacts of extreme weather events due to climate change and builds resiliency in municipal infrastructure
- Evaluate any changes/impacts to local groundwater quality and the potential to decrease chloride loadings to groundwater.
- Monitor and assess the operational and maintenance needs of LID systems and the subsequent effects on performance.
- Meet the objectives of CVC’s monitoring strategy report (available at www.bealeader.ca)
- Preliminary performance data will be published soon.

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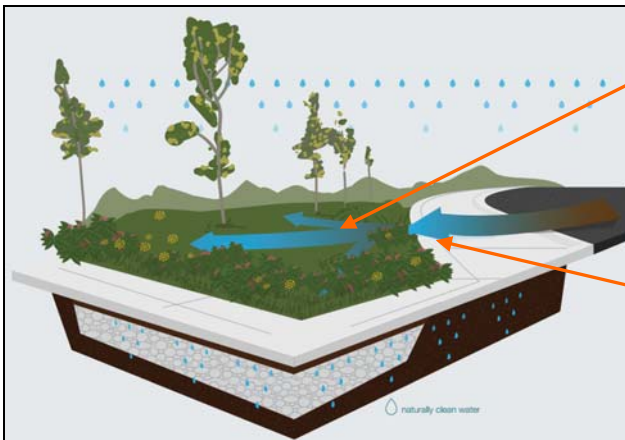
Lakeside Park

Location: Mississauga
Constructed: 2011



Project Overview

The City of Mississauga's 25 acre Lakeside Park features many innovative green features including a pervious concrete parking lot, green roof, bioswale (rain garden) and splash pad with water reused for park irrigation. CVC, in partnership with the City of Mississauga, is evaluating the performance of the bioswale.



Bioswale

The bioswale collects stormwater run-off from the parking lot and cleans the water through an engineered soil mixture and selected vegetation. In the rain garden, the interaction of plants, soil and natural microbes remove pollutants to improve the quality of water flowing back into Lake Ontario – our drinking water source.

Sheet Flow

The design does not include a curb to promote inflow of stormwater runoff. The parking lot runoff enters the rain garden as sheet flow.

Successes

CVC, in partnership with the City of Mississauga, is conducting regular maintenance inspection and evaluating the performance of the rain garden. The successes achieved with this project include:

Innovative project – Lakeside Park includes a number of innovative low impact development practices. The project demonstrates the City’s commitment to leading by example.

Protecting the Great Lakes – This project embraces the spirit of the Lake by showcasing how to manage and clean stormwater before it enters the Lake.

Demonstration showcase – Lakeside Park have been showcased in presentations, events and site tours. These efforts have helped educate numerous stakeholders on the benefits of LID.

Public Acceptance – The bioswale landscape design has received a lot of positive feedback from the public. This has helped to increase public recognition and acceptance of LID.

Infrastructure Assessment

As part of CVC’s Showcasing Water Innovation Project, the performance of Lakeside Park rain garden is being evaluated. This assessment will help to provide municipalities and property managers with the information and tools they need to ensure that LID practices on their property are working properly.

Performance – preliminary assessments indicate that the bioswale is performing well.

Landscaping – the bioswale landscaping consists of straight lines, groupings and tiers. The plants have had two years to establish and have been found to thrive.

Maintenance – the City of Mississauga has been performing maintenance including litter pickup, weeding, and some irrigation. The bioswale has received the same level of maintenance as other City properties.



Green Roof is another feature on-site



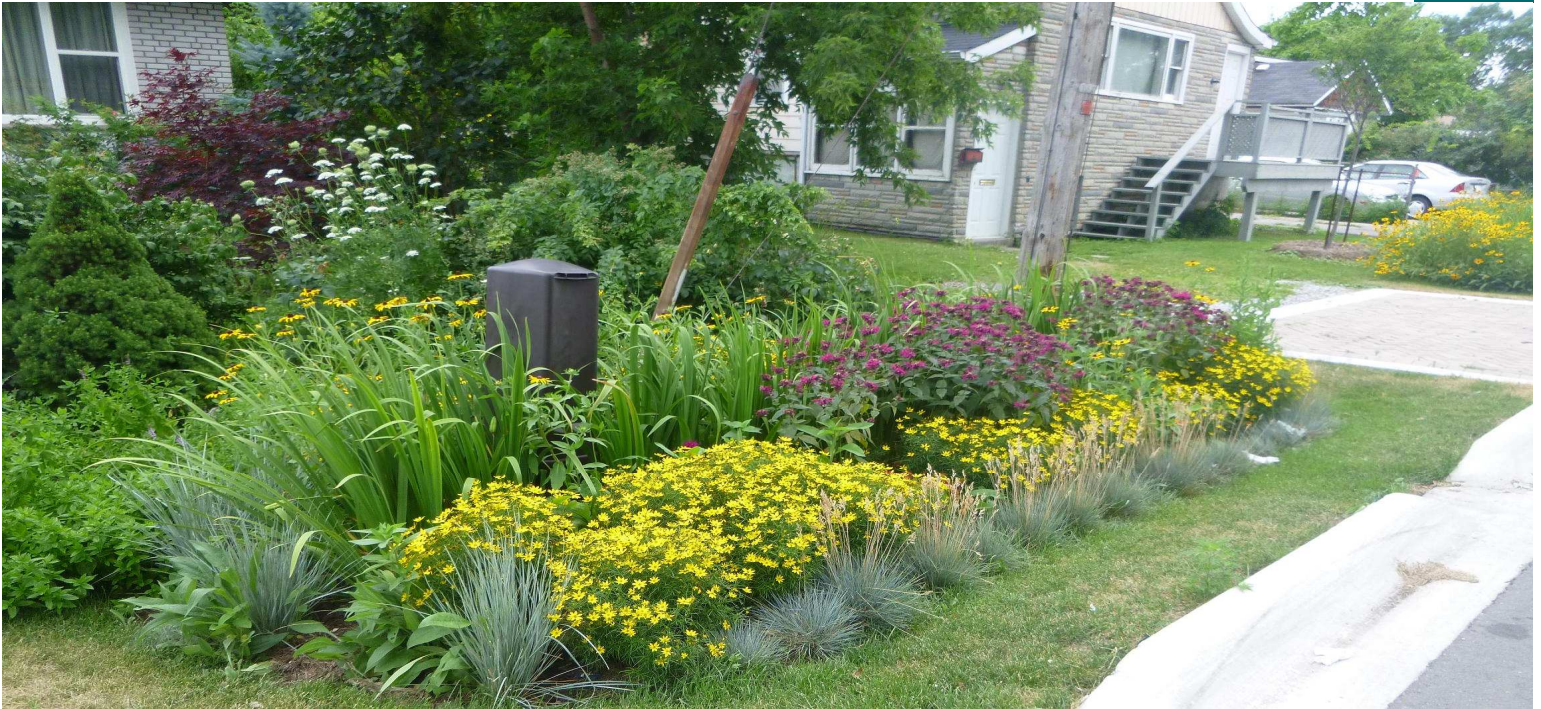
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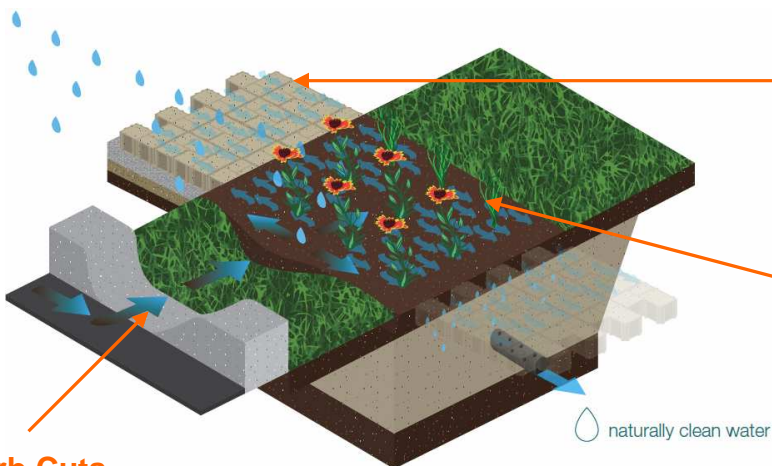
Lakeview

Location: Mississauga
Constructed: August 2012



Project Overview

In the Lakeview community in Mississauga, portions of older residential roads with roadside ditches were upgraded with low impact development (LID) features within the road right-of way. The LID retrofits include permeable paver driveways and boulevard bioretention units, both of which help reduce stormwater runoff and improve water quality flowing into Lake Ontario. Construction of the Lakeview green street project was completed in August, 2012 with LID monitoring beginning in the same month.



Curb Cuts

Street runoff enters the bioretention units through the curb cuts.

Permeable Pavers

An alternative to traditional asphalt this LID allows rainfall and road runoff to be filtered as it flows through the pavers and returns to the ground.

Boulevard Bioretention Units

The bioretention units, located in the boulevard, absorb and filter rainfall and road runoff as the water flows through the plants and soils and back into the ground.

Successes

The successes achieved with this project include:

Innovative project – the Lakeview project was one of the first residential green street retrofits in Ontario. The project will help to demonstrate that LID practices can be effectively implemented to help upgrade older roads with roadside ditches.

Community engagement – residents of the Lakeview community were extensively consulted to ensure buy-in before the boulevard bioretention units were constructed. Residents were also given the opportunity to select the desired landscape for the bioretention boulevard units in front of their property – 21 of the 26 homes selected perennial flowers over sod.

Reduce costs by 25% – by retrofitting the road using LID as opposed to typical curb-and-gutter, the City was able to reduce the cost of the road resurfacing by 25%, while providing additional stormwater management benefits.

Performance - Preliminary results shows that the Lakeview bioretention boulevard units are able to completely infiltrate rain events 23 mm or less which accounts for 90 % of annual rain events.

Demonstration showcase – The LID features at Lakeview have been showcased through numerous presentations, events and site tours. These efforts have helped educate many stakeholders on the benefits of LID.

Infrastructure Assessment

CVC is working with an expert advisory committee consisting municipalities, regional government, the MOE, consultants, universities and industry to assess the performance of the LID features at Lakeview. Objectives include:

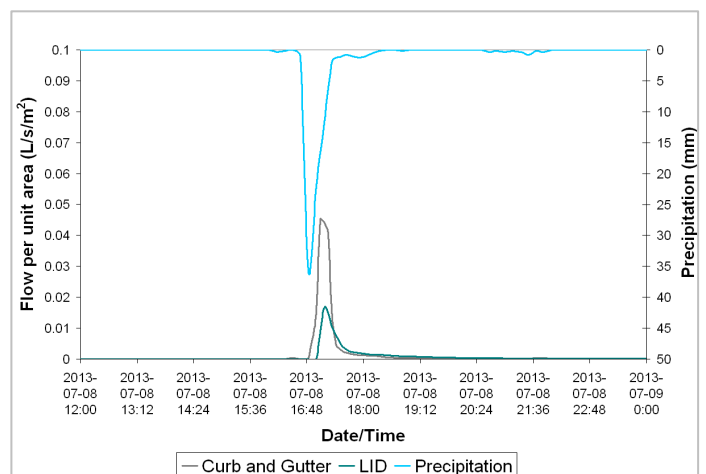
- To evaluate the performance of LID at controlling runoff volume, peak flows, quality, erosion and restoring the natural water balance.
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100 Year Event - July 8, 2013

On July 8, 2013 an extreme event occurred over Lakeview - 104 mm over 5 hours, peak intensity of 240 mm/hr for a duration of 10 minutes. Preliminary analysis indicates that this storm event exceeded the 100-year design storm.

As the figure shows, even for this extreme event, the LIDs at Lakeview helped to provide some peak flow control.



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